Water Quality and Habitat Assessment Reports

Potomac and Patuxent

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TMAW presentation

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MARYLAND DEPARTMENT OF NATURAL RESOURCES

Intent of reports

- summarize the water and habitat quality data collected in non-tidal and tidal long-term and shallow water monitoring programs
- Include supporting information (land use, loadings) and living resources information (phytoplankton/HABs, SAV, benthos)
- Include information on management actions

Objective of this talk

Overview of what is in the reports, examples from Potomac and Patuxent reports

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Acknowledgements:

Information on the water and habitat quality of Maryland's rivers and bays is available due to the hard work of many dedicated staff including:

- staff who are in the field collecting the samples year-round, sometimes under less than desirable weather conditions
- laboratory staff who perform the chemical tests to determine what exactly is in those water samples
- data management staff who collect the resulting information, confirm the accuracy and quality of the data, and organize and maintain the databases and
- analytical staff who interpret the data to answer the question 'how is the river/Bay doing?'

There are too many individuals to directly name from more than 25 years of monitoring, so we simply wish to commend all of them for their commitment to collecting high quality information and making it available and useful to the citizens of Maryland.

Supporting information

- 2010 data from the U.S. Census Bureau http://www2.census.gov/census_2010/04-Summary_File_1/
- Maryland Department of Planning data for 2010 http://www.planning.maryland.gov/OurWork/landUse.shtml
- Maryland Department of Planning Land Use/ Land Cover Classification Definitions http://www.planning.maryland.gov/PDF/OurWork/LandUse/AppendixA_LandUseCategories.pdf .
- Impervious surface calculated from definitions in Cappiella and Brown, Urban Cover and Land Use in the Chesapeake Bay watershed, Center for Watershed Protection, 2001, as referenced in Table 4.1 of a User's Guide to Watershed Planning in Maryland http://dnr.maryland.gov/watersheds/pubs/userguide.html
- Information on Maryland's Trust Fund http://www.dnr.maryland.gov/ccp/funding/pdfs/TrustFundPriorities.pdf
- Maryland Department of Natural Resources data www.streamhealth.maryland.gov/stream_health.asp
- http://dnr.maryland.gov/watersheds/surf/proj/wras.html.
- Information on land conservation programs in Maryland http://www.dnr.state.md.us/land/landconservation.asp
- Maryland's Phase II Watershed Implementation Plan www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/FINAL_PhaseII_WIPDocument_Main.aspx
- Progress toward meeting the 2011-2013 milestones www.baystat.maryland.gov/milestone_information.html
- Chesapeake Bay Program Loadings data. Accessed January 10, 2012 from http://www.chesapeakebay.net/watershedimplementationplantools.aspx?menuitem=52044 File
- (https://archive.chesapeakebay.net/Modeling/phase5/Phase53_Loads-Acres-BMPs/MD/Load_Acres_MDWIP_08252010.xls)
- Chesapeake Bay Restoration Fund http://www.mde.state.md.us/programs/Water/BayRestorationFund/Pages/index.aspx.
- Maryland Department of Agriculture http://mda.maryland.gov/resource_conservation/Pages/nutrient_management.aspx
- http://mda.maryland.gov/resource_conservation/Documents/scwqplan.pdf
- Progress on different BMPs http://www.baystat.maryland.gov/milestone_information.html
- For more information on Blue Plains http://www.dcwater.com/wastewater/blueplains.cfm
- Blue Plains Intermunicipal Agreement of 2012 http://www.mwcog.org/uploads/pub-documents/u15dVlc20130506094101.pdf
- VA loadings from Virginia Dept. of Environmental Quality http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/NutrientTrading.aspx.
- USGS methods http://md.water.usgs.gov/publications/sir-2006-5178/index.html
- Non-tidal loadings trends are from USGS http://cbrim.er.usgs.gov/loads_query.html
- An interactive map of all continuous monitoring stations and complete archived data http://mddnr.chesapeakebay.net/newmontech/contmon/archived_results.cfm.
- Interpolated maps for all cruises are available on the Maryland Department of Natural Resources "Eyes on the Bay" website http://mddnr.chesapeakebay.net/sim/dataflow_data.cfm
- Virginia shallow water monitoring data retrieved from Chesapeake Bay Program databases http://www.chesapeakebay.net/data/downloads/cbp_water_quality_database_1984_present
- Boynton et al (2011) http://www.gonzo.cbl.umces.edu/documents/water_quality/Level1Report28.pdf
- Methods for calculation of the PIBI http://www.chesapeakebay.net/images/indicators/5387/indicator_survey_phyto_ibi_2012_final.docx
- PIBI scores calculated by J. Johnson, Interstate Commission on the Potomac River Basin/Chesapeake Bay Program.
- Information on Harmful Algal Blooms http://mddnr.chesapeakebay.net/eyesonthebay/habs.cfm
- Reports detailing methodology and annual SAV coverage www.vims.edu/bio/sav .
- Details on species of SAV discussed in this report www.dnr.maryland.gov/bay/sav/key
- Methods for calculation of the BIBI are available at http://www.baybenthos.versar.com/DsgnMeth/Analysis.htm
- status calculation methods http://mddnr.chesapeakebay.net/eyesonthebay/documents/ICPRB09-4_StatusMethodPaperMolson2009.pdf.
- trends calculation methods see http://mddnr.chesapeakebay.net/eyesonthebay/documents/stat_trend_hist.pdf.
- US EPA Chesapeake Bay dissolved oxygen criteria for deep-water seasonal designated use (June- September). www.chesapeakebay.net/content/publications/cbp_13142.pdf.
- DIN is compared to a nitrogen limitation threshold value of less than 0.07 mg/l (Fisher and Gustafson 2002, http://www.hpl.umces.edu/gis_group/Resource%20Limitation/2002_report_27Oct03.htm#es).
- Submerged aquatic vegetation (SAV) growing season median concentrations compared to SAV habitat requirements using the methods of Kemp et al. (2004) http://archive.chesapeakebay.net/pubs/sav/savreport.pdf

http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm

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Tributary Water Quality and Habitat Assessments

*Through 2010

Through 2012

Detailed reports on the health of Bay tributaries

- * Upper Western Shore
  - 2010-2012 Water Quality Update
- * Patapsco and Back Rivers
  - 2010-2012 Water Quality Update
- * Lower Western Shore
  - 2010-2012 Water Quality Update
- Potomac River
  - 2010-2012 Water Quality Update
- * Upper Eastern Shore
  - 2010-2012 Water Quality Update
- * Choptank, Little Choptank and Honga Rivers
  - 2010-2012 Water Quality Update
- * Lower Eastern Shore
  - 2010-2012 Water Quality Update
- Patuxent River
  - 2010-2012 Water Quality Update

Overall Condition

How healthy is my river?

How does my river compare to other rivers?

What needs to be done to make my river healthy?

What has already been done to improve water and habitat quality in my river?

The full report includes:

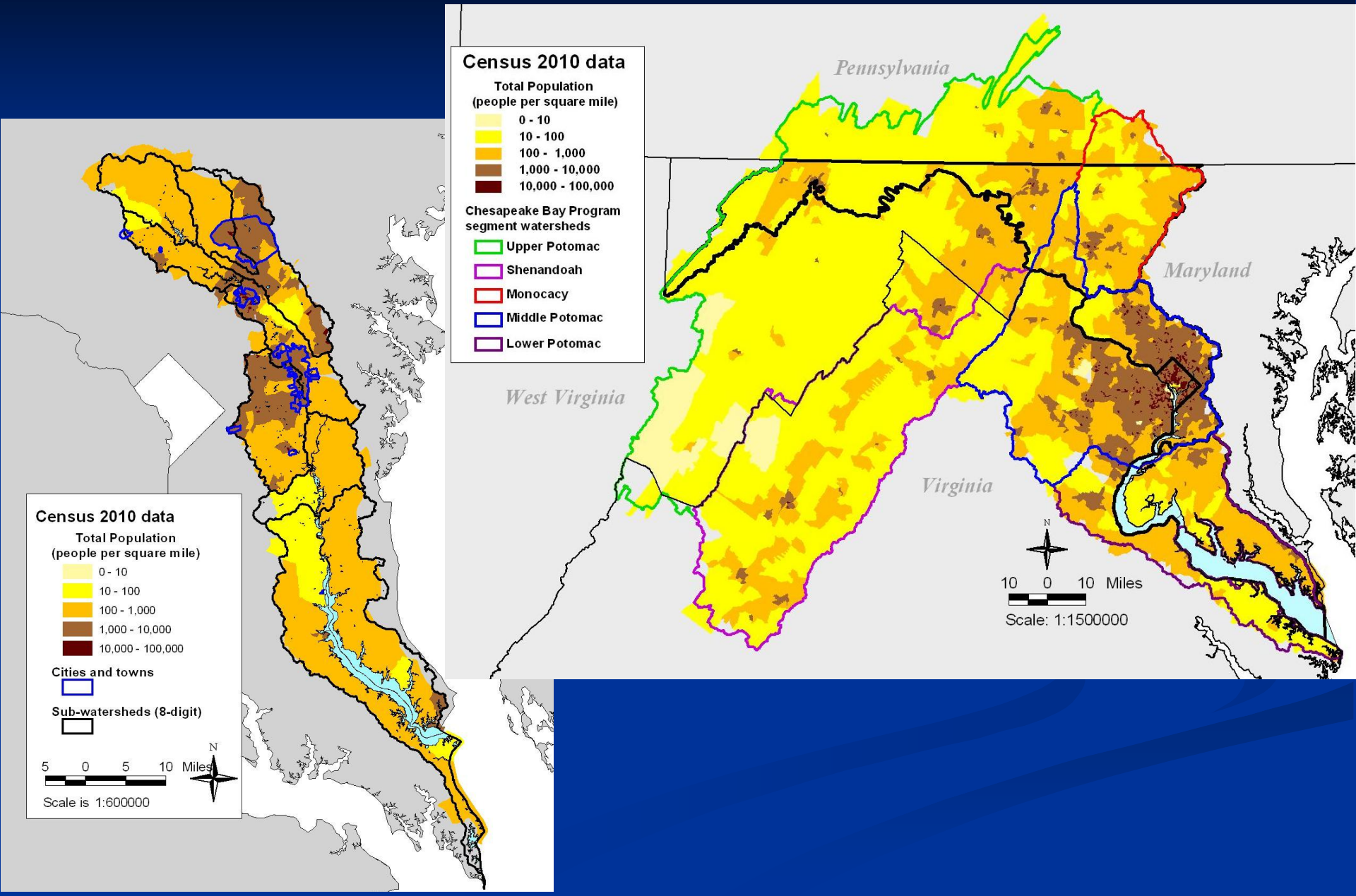
- Information on land use and human population densities within the basin, including the health of streams and location of Maryland Trust Fund Priority watersheds
- Information on land use in 2010, change in land use since 2000 and percent impervious surfaces in watershed
- Nutrient and sediment loadings information, including breakdown of nitrogen, phosphorus and sediment load by source (agriculture, urban runoff, point source, etc.)
- Loadings information for major wastewater treatment plants including status of upgrades and progress toward loading caps
- Water and habitat quality results for non-tidal streams and tidal waters from long-term monitoring programs
- Shallow-water monitoring results including percent failures of dissolved oxygen, chlorophyll and turbidity thresholds and comparison to long-term monitoring stations
- Phytoplankton information, Submerged aquatic vegetation coverages, Benthic program results
- Appendices with station locations, analysis methods and tabular results

Examples in talk:

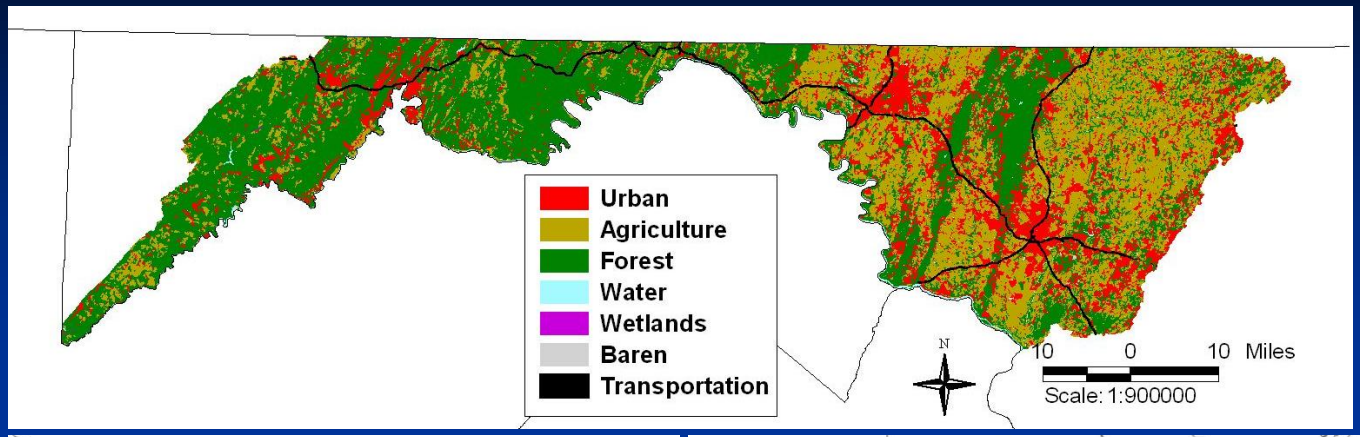
- human population densities (census data)
- land use
- nutrient and sediment loadings
- loadings for major wastewater treatment plants

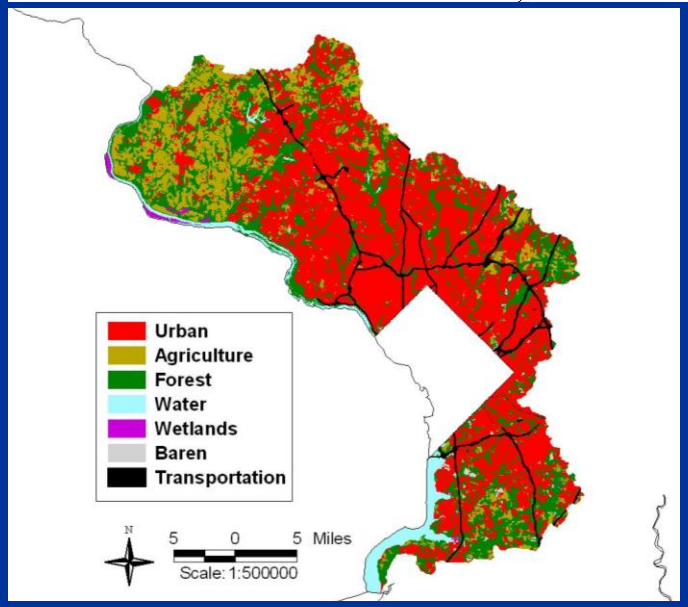
- water and habitat quality results: non-tidal streams and tidal waters
- shallow-water monitoring results
- phytoplankton information, submerged aquatic vegetation coverages, benthic program results

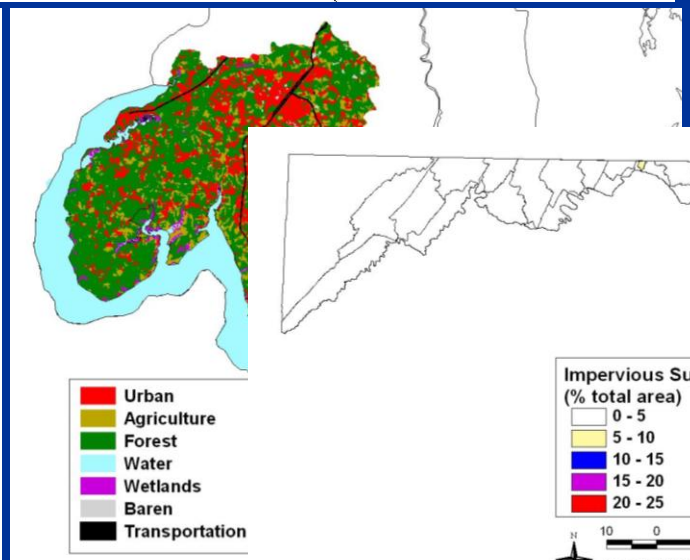
2010 Census data



2010 Landuse data







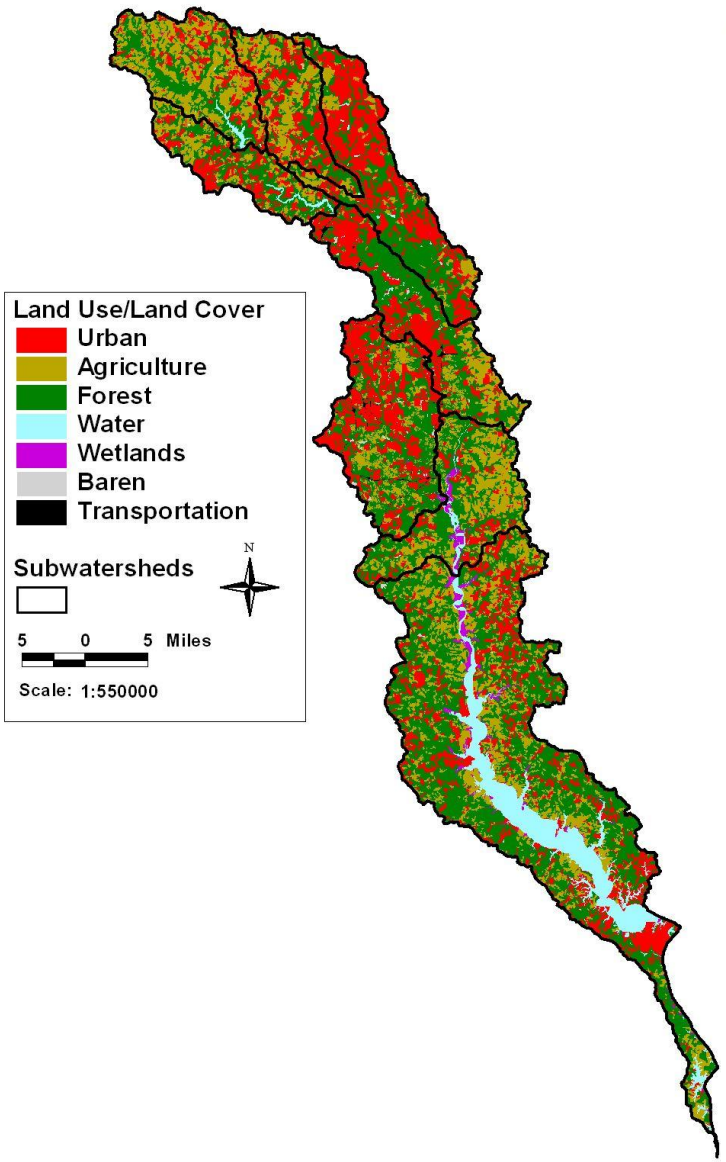
Appendix with tabular data by sub-watershed for both 2000 and 2010

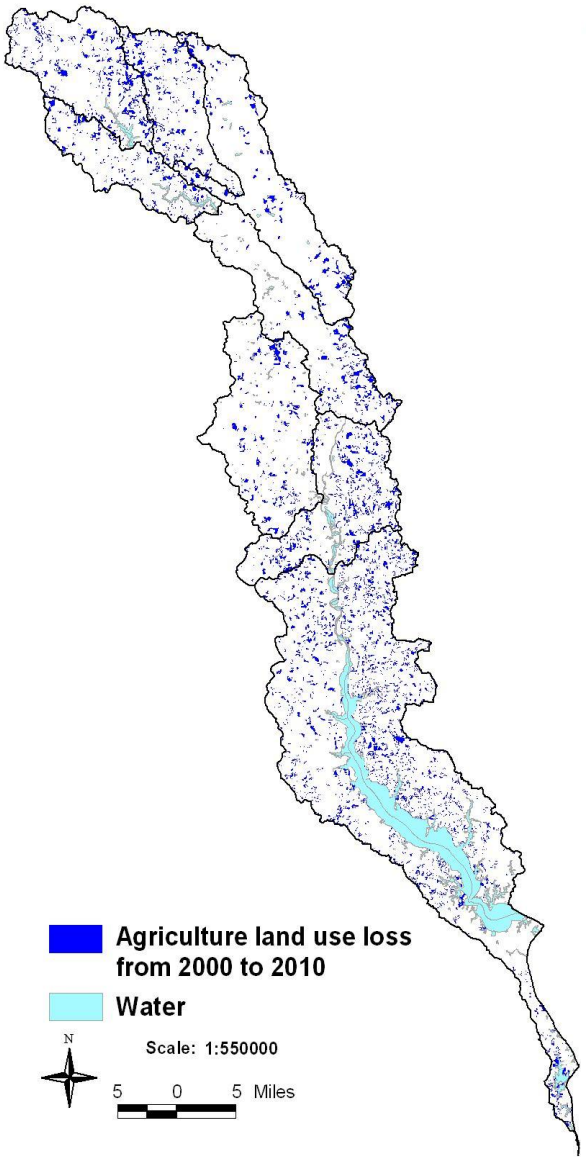
Percent Impervious Surfaces

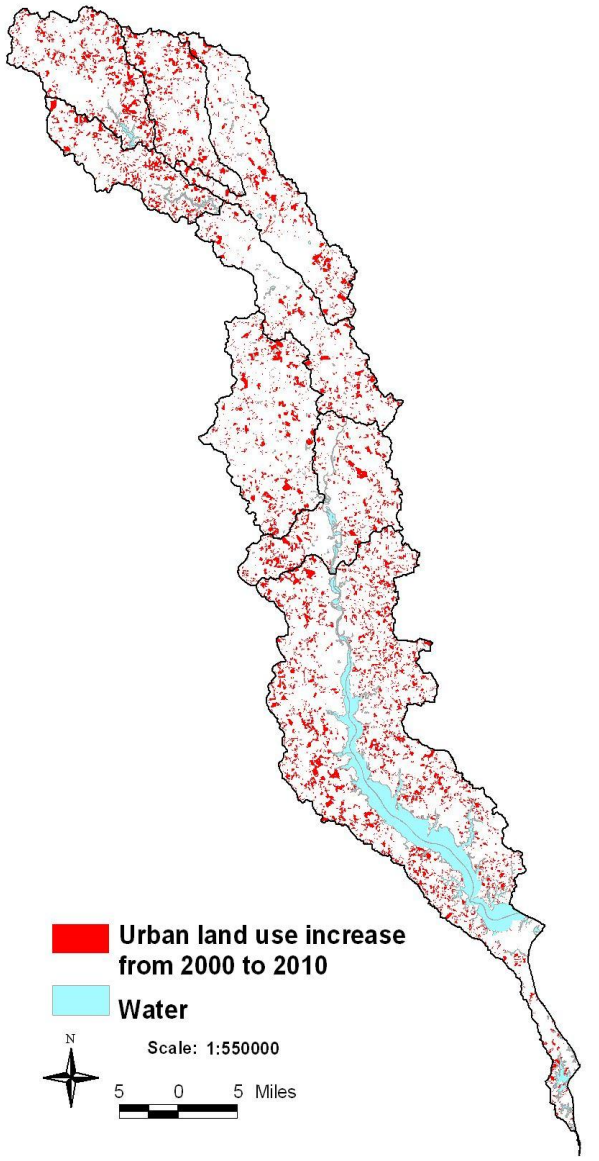
2010 Landuse data

Ag loss

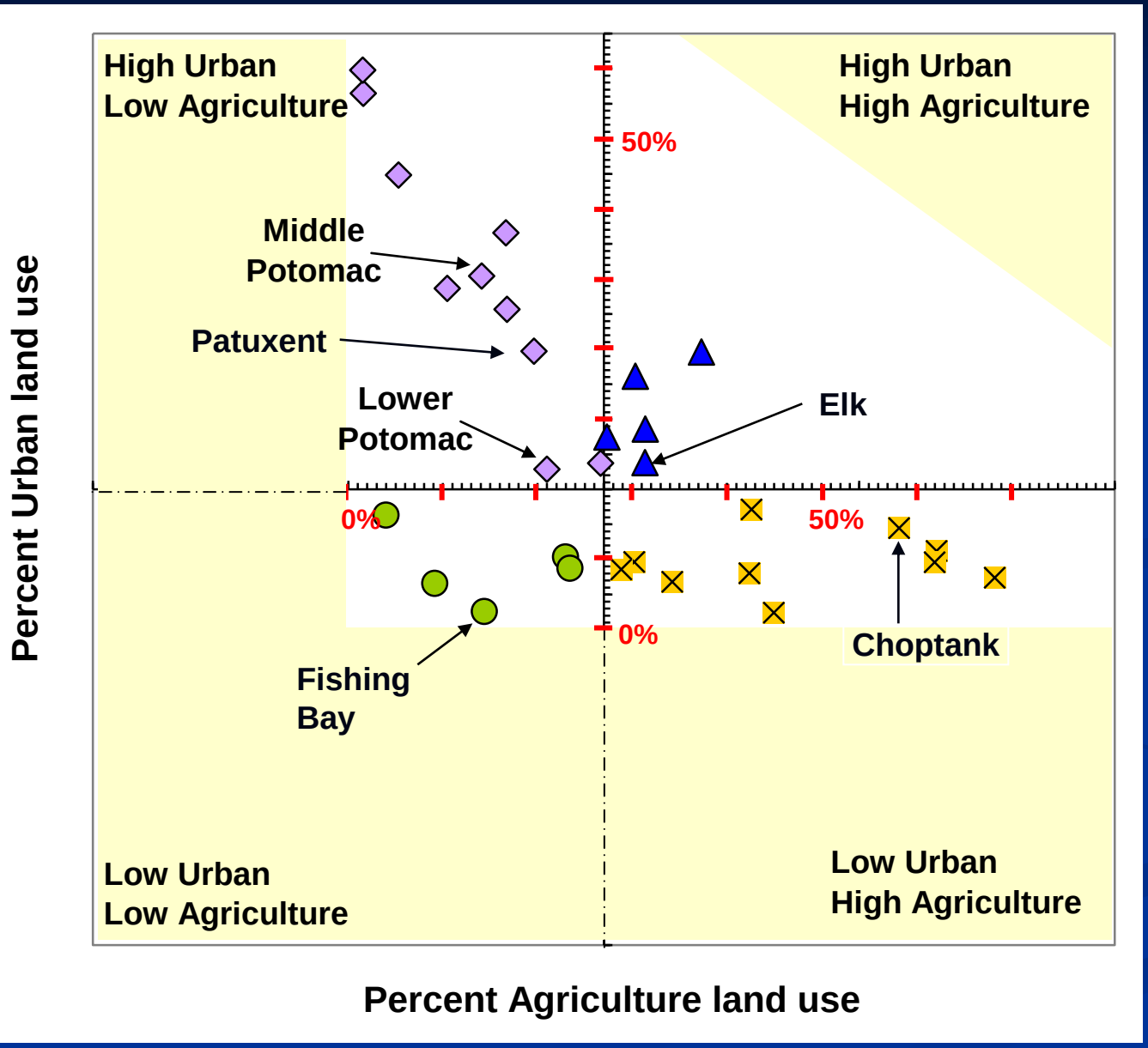
Urban increase



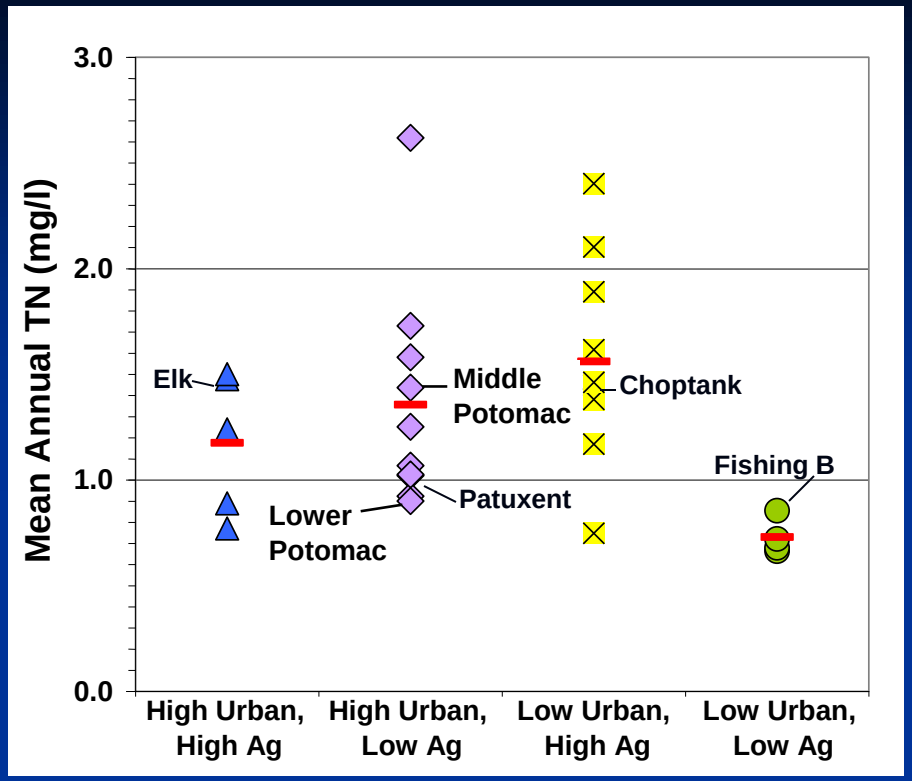


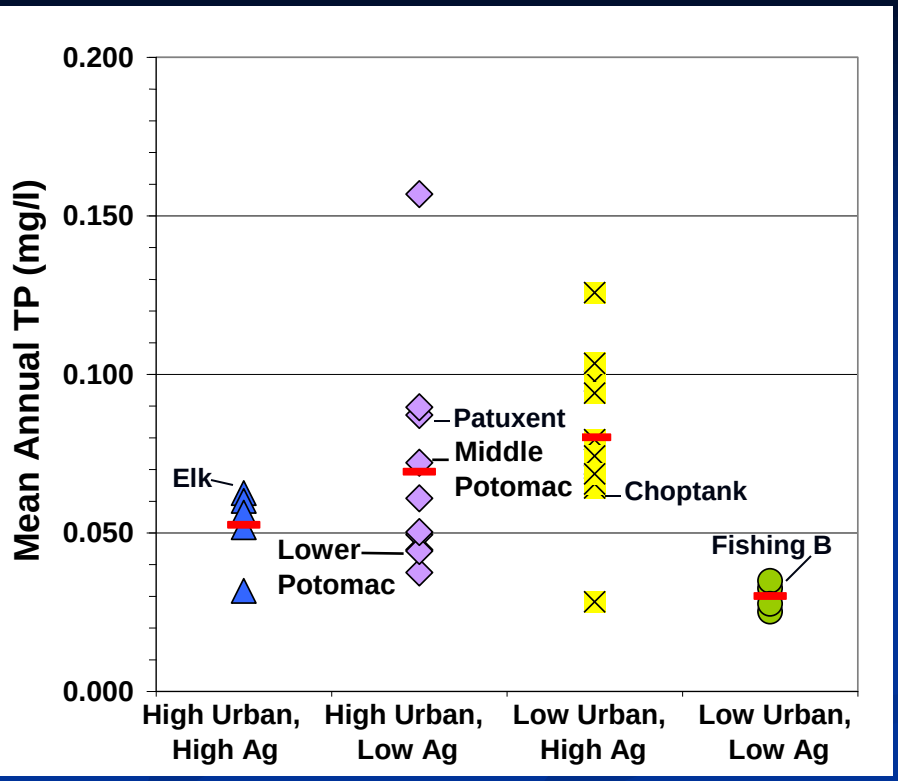


How does my river compare to other rivers?



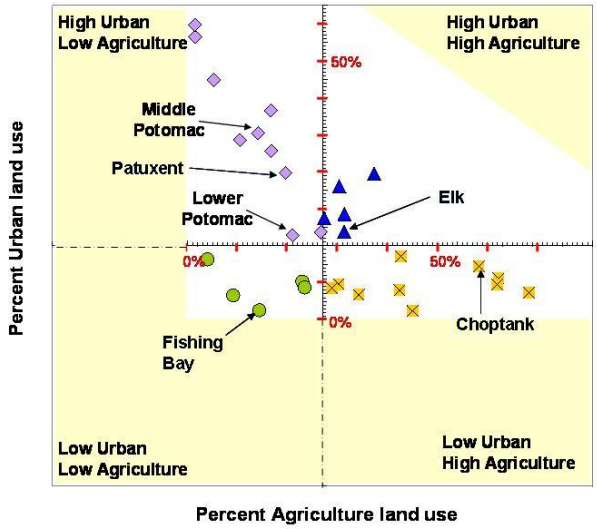
The medians of all systems % Ag and % Urban land use are used to create a grid with four categories.





The mean annual concentration for 2010-2012 data: TN, TP, TSS, Chl *a*, Secchi, Summer Bottom DO

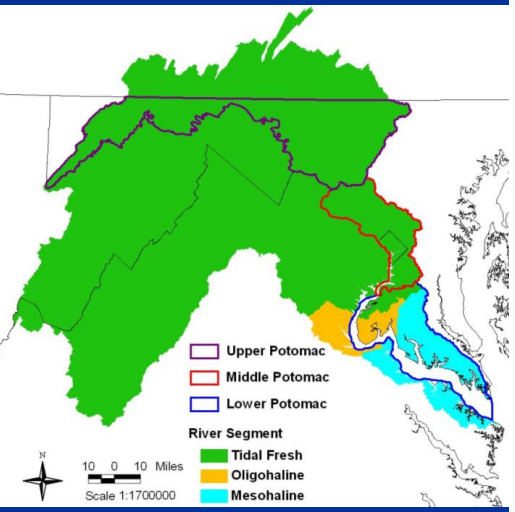
Red bars indicate the mean of all systems within a category.



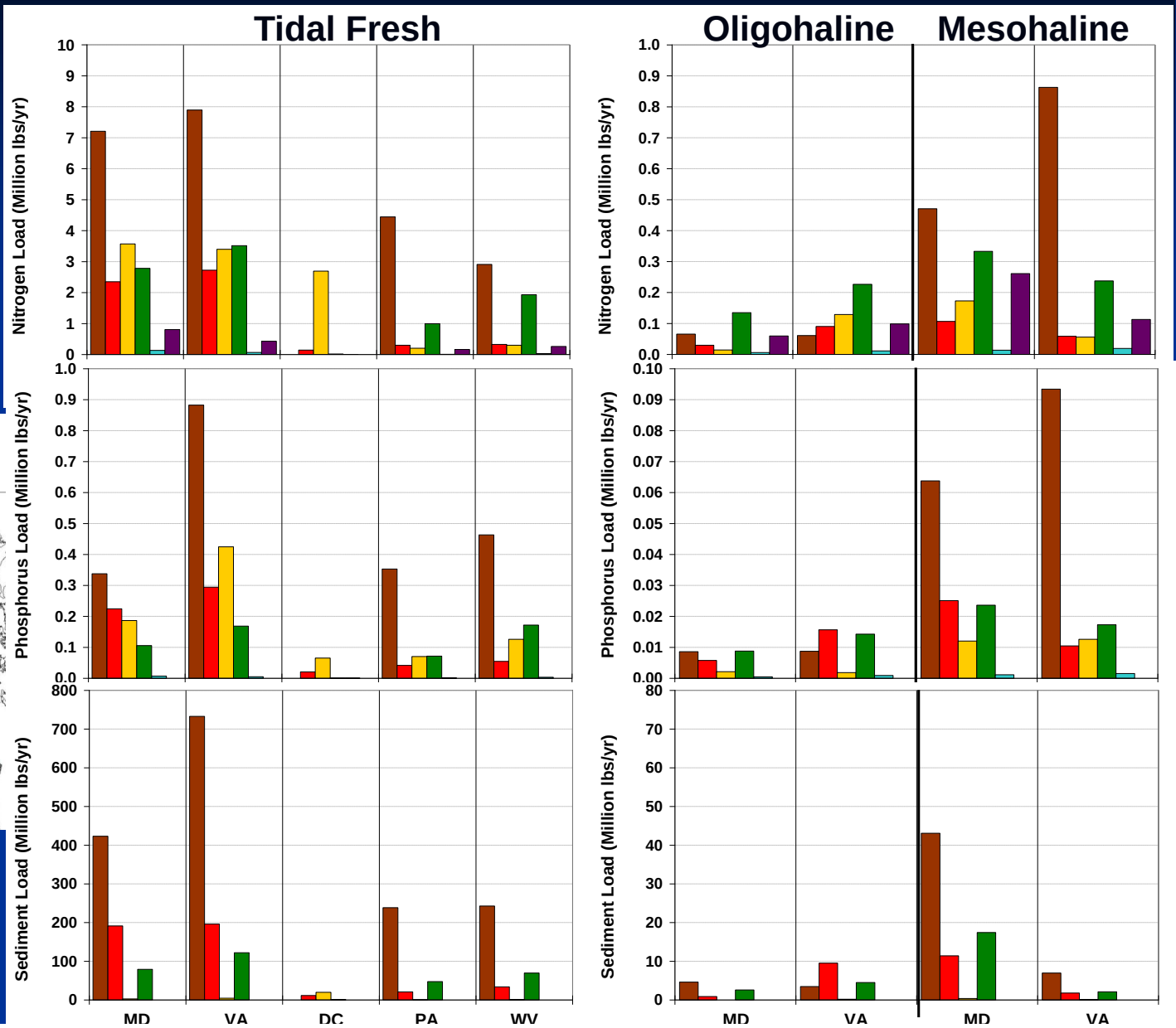
Nitrogen, Phosphorus, Sediment Loadings per year

Appendix with tabular data by Bay Program segment
MD, VA, DC, PA, WV

2009 Loadings
Phase 5.3 2009 Progress Run 8/25/2010



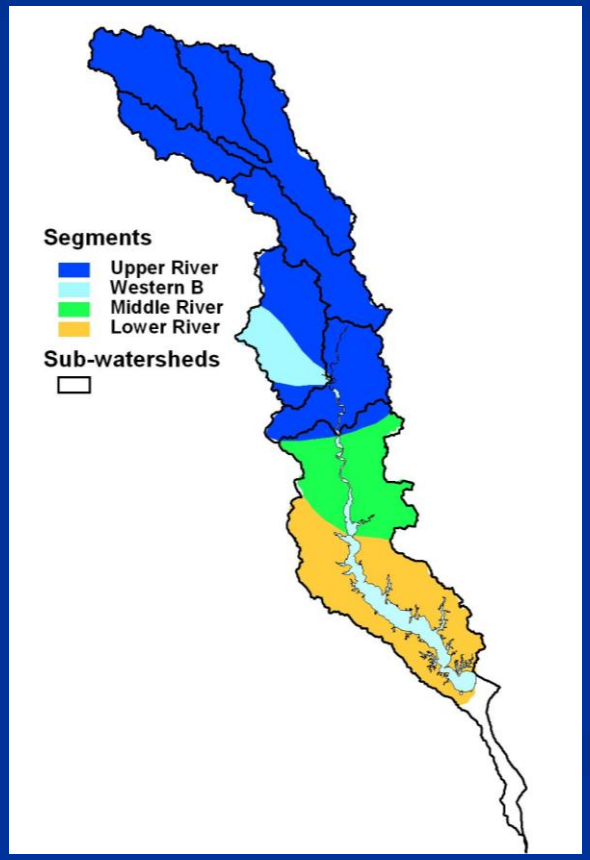
Note that y-axis scale for Tidal Fresh is 10X scale for Oligohaline/ Mesohaline

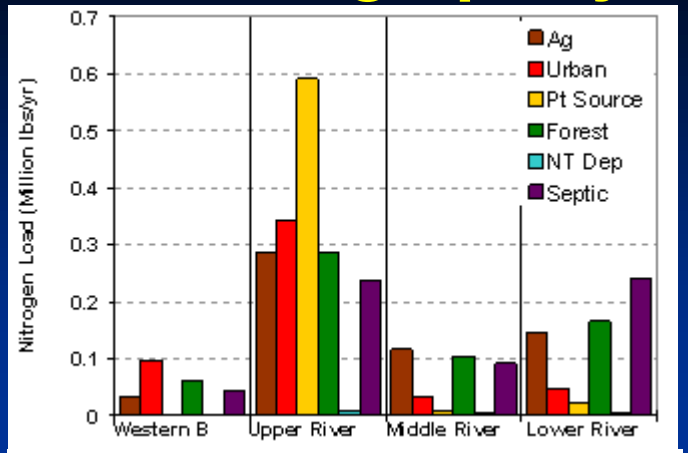


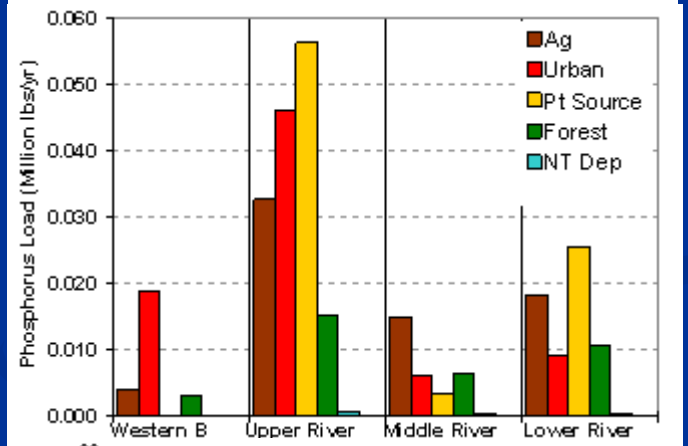
Nitrogen, Phosphorus, Sediment Loadings per year

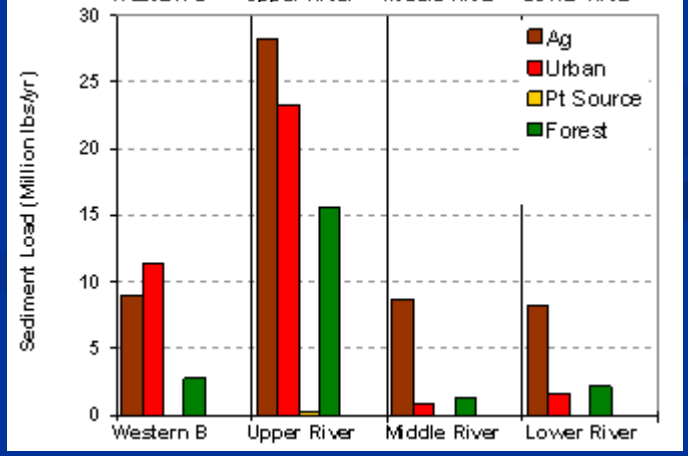
Appendix with tabular data by Bay Program segment

2009 Loadings
Phase 5.3 2009 Progress
Run 8/25/2010

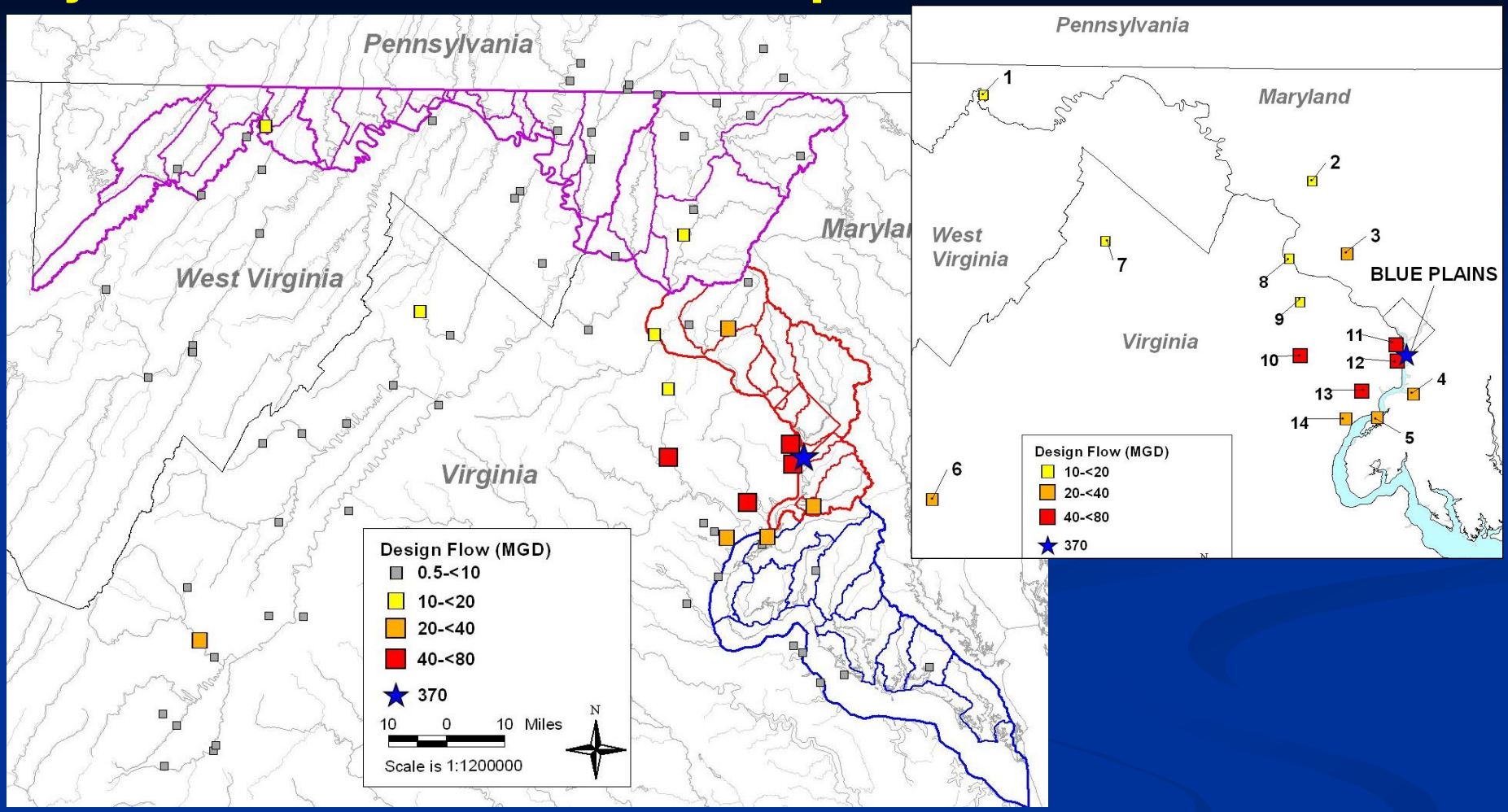








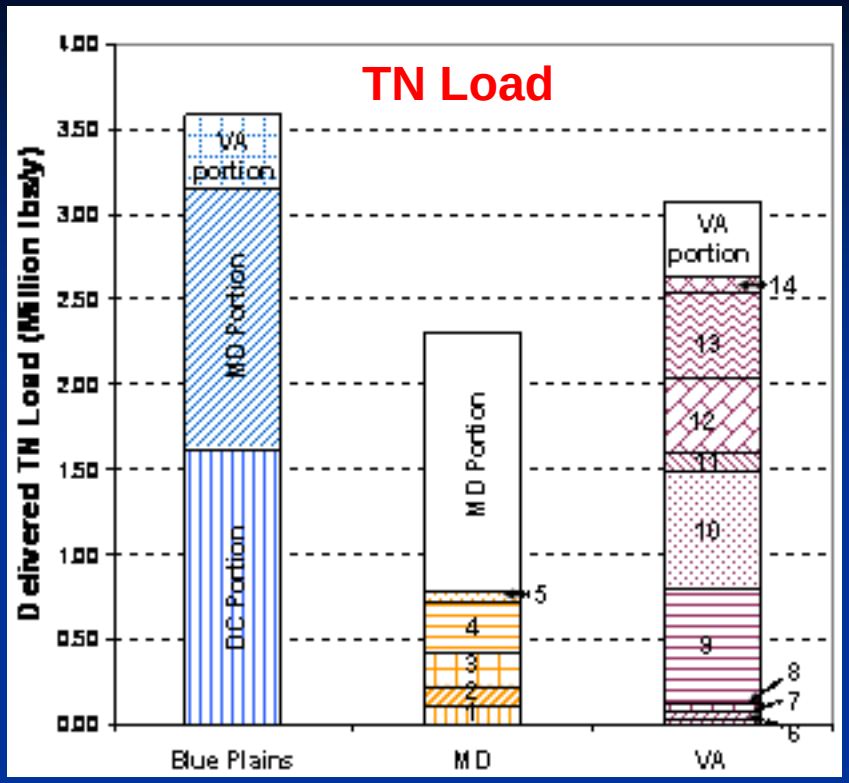
Major Wastewater treatment plants

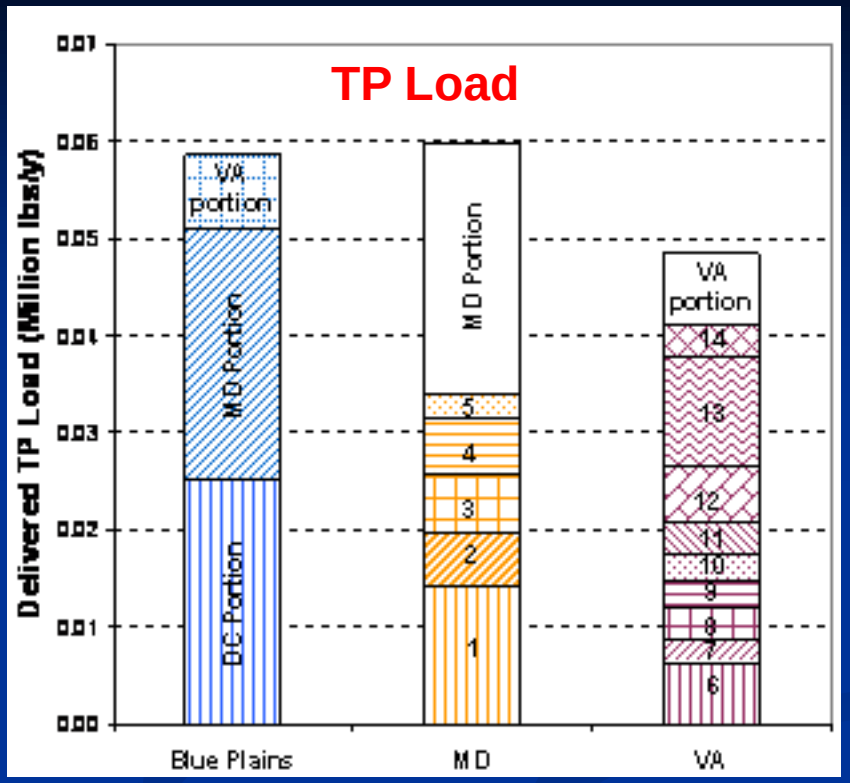


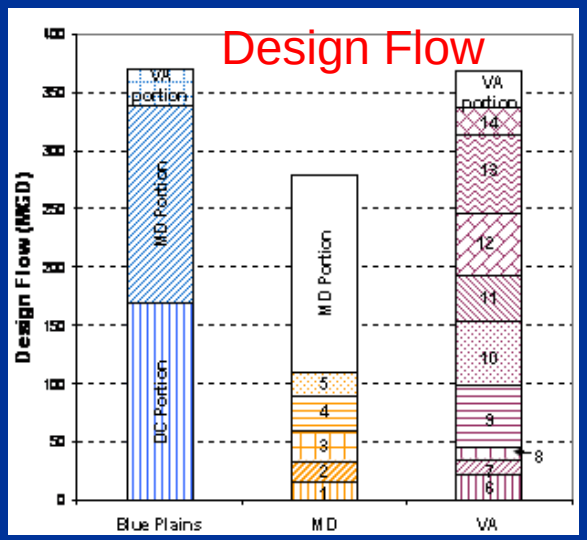
Largest wastewater treatment plants discharging to the Potomac River.

Main panel: Design flow (in million gallons per day, MGD) shown along with major tributaries (light grey lines) to the Potomac. Upper (purple lines), Middle (red lines) and Lower (blue lines) Potomac sub-watersheds in Maryland also shown. Blue Plains wastewater treatment plant (shown with blue star) is the largest single wastewater treatment plant discharging in the Potomac basin. Blue Plains serves Maryland, District of Columbia and Virginia. Insert panel: Maryland facilities greater than 10 MGD are: 1-Cumberland, 2-Ballenger Creek, 3-Seneca Creek, 4-Piscataway, and 5-Mattawoman. Virginia facilities greater than 10 MGD are: 6-HRRSA-North River, 7-Opequon, 8-Leesburg, 9-LCSA-Broad Run, 10-Upper Occoquan S.A., 11-Arlington Co., 12-Alexandria S.A., 13-Fairfax Co.-Noman-Cole, 14-PWCSA-H.L. Mooney.

Blue Plains Wastewater treatment plant



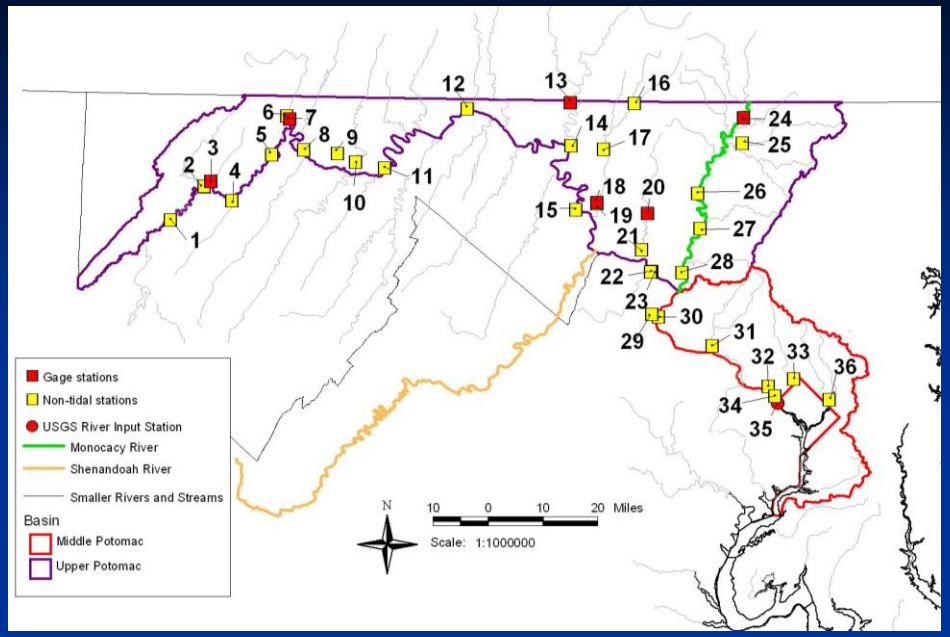


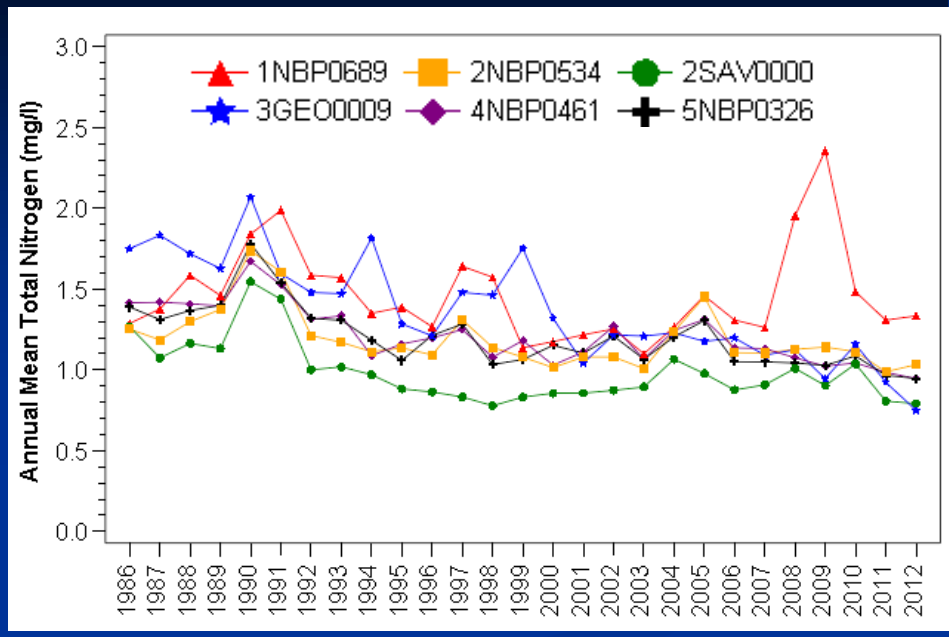


Relative comparison of TN and TP loadings to the Potomac River by state and facility for 2011.

Note that the Maryland and Virginia portions of Blue Plains loadings are also included at the top of the individual states bars (in white) to allow comparison between not only the relative contribution of Blue Plains to the rest of the wastewater treatment plants overall, but also the relative comparison of D.C., Maryland and Virginia loadings.

Long-term Non-tidal water quality

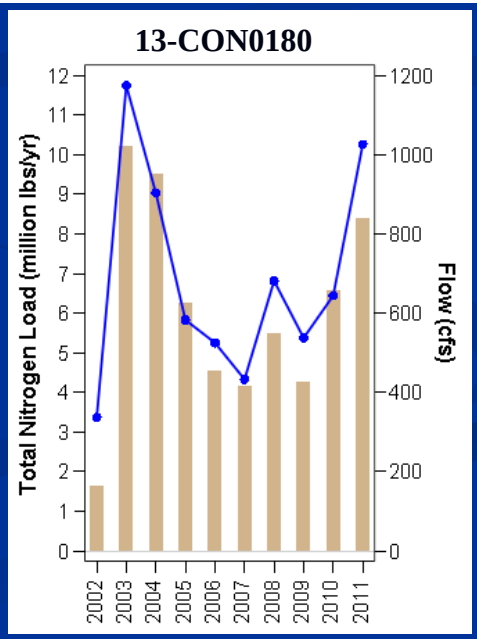




Long-term non-tidal water quality monitoring stations. Red squares are USGS gage stations.

Graphs of TN, TP, Sediments 1986-2012
Trends in non-tidal water quality for 1999-2012
(1986-2012 in footnotes)
Appendix with results by station

USGS TN, TP, Sediments loads
trends in loadings for WY 2002-2011
and WY 1985-2011



Annual flow is shown in blue

Summary of trends for non-tidal loadings (WY2002-2011) and non-tidal water quality parameters trends (1999-2012).

Annual trends ether 'Increase' or 'Decrease' if significant at $p \leq 0.01$ or 'Maybe Increase' or 'Maybe Decrease' at $0.01 < p < 0.05$; blanks indicate no significant trend. Improving trends are in green, degrading trends are in red. Gray boxes indicate there is no data to evaluate that component.

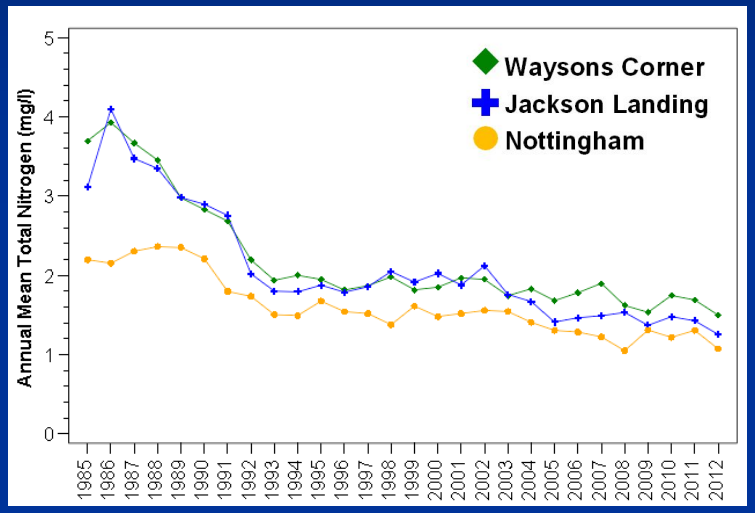
			Loadings			Water Quality		
	map#	Station	Nitrogen	Phosphorus	Sediments	Nitrogen	Phosphorus	Sediments
	1	NBP0689				INCREASE		INCREASE
	2	SAV0009						
	10	TOW0030				DECREASE		
	11	POT2766				DECREASE		
	12	POT2386				DECREASE		DECREASE
Eastern Upper Potomac	13	CON0180		DECREASE		INCREASE	DECREASE	Maybe Decrease
	14	CON0005				INCREASE	DECREASE	DECREASE
	15	POT1830					DECREASE	
	16	ANT0366				INCREASE		DECREASE
	17	ANT0203				INCREASE	DECREASE	DECREASE
	18	ANT0044				INCREASE	DECREASE	
	20	CAC0148		DECREASE			DECREASE	
	21	CAC0031					DECREASE	Maybe Decrease
	22	POT1596				DECREASE	DECREASE	
	23	POT1595					DECREASE	
Monocacy River	25	MON0528	DECREASE	DECREASE		Maybe Decrease	DECREASE	Maybe Decrease
	26	BPC0035					DECREASE	
	27	MON0269					DECREASE	
	28	MON0155				DECREASE	DECREASE	
	29	MON0020				DECREASE	DECREASE	
Middle Potomac	30	POT1472				Maybe Decrease	DECREASE	
	31	POT1471					DECREASE	
	32	SEN0008				DECREASE	DECREASE	
	33	CJB0005						
	34	RCM0111						
	35	POT1184					DECREASE	
	37	ANA0082					Maybe increase	INCREASE
	36	Potomac River at Chain Bridge, MD			INCREASE			

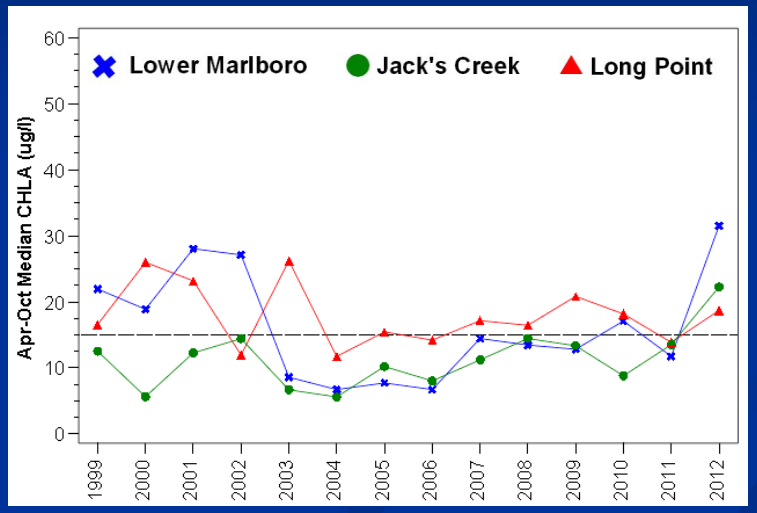
STATION	Loadings			Water Quality		
	Nitrogen	Phosphorus	Sediments	Nitrogen	Phosphorus	Sediments
Unity			INCREASING	INCREASING	DECREASING	
Rocky Gorge						
Bowie (Fall Line)	DECREASING			DECREASING	DECREASING	

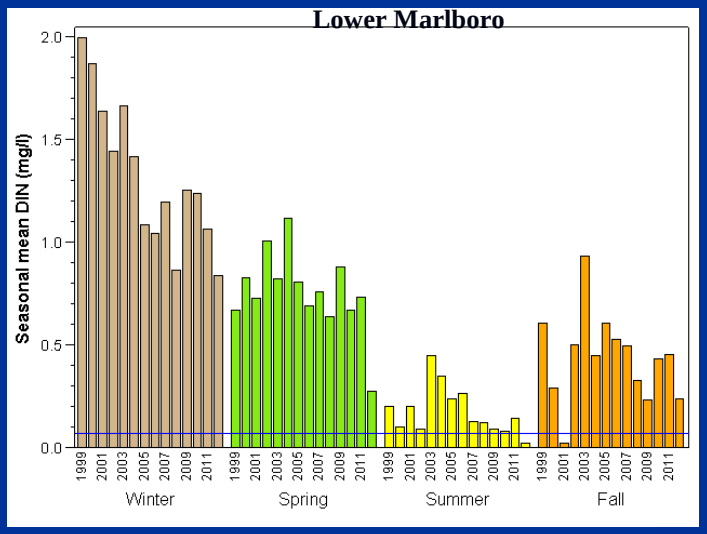
Appendix with detailed results for non-tidal water quality trends

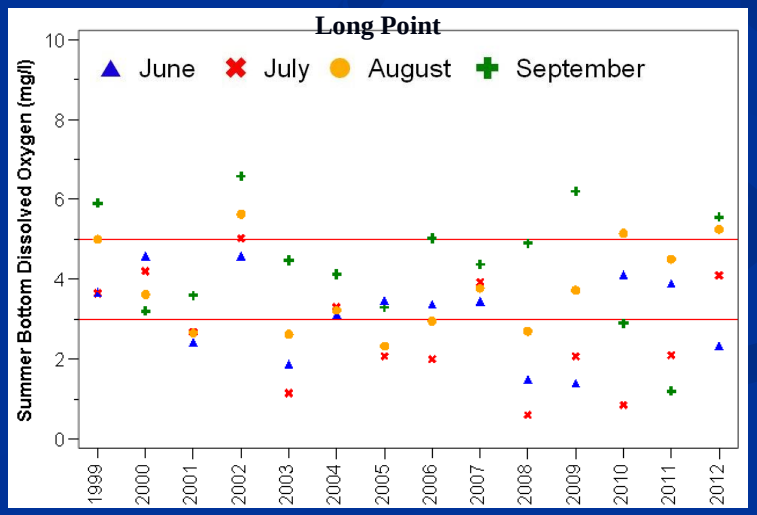
Long-term Tidal water quality

Annual and seasonal trends for 1999-2012 (1985-2012 annual trends in footnotes)
Graphs of Annual TN, TP, TSS for 1985-2012
Graphs of SAV season PO_4, TSS, Chlorophyll *a*, Secchi Depth for 1999-2012
Graphs of Nutrient Limitation by season, by station
Graphs of Summer Bottom dissolved oxygen by station









Summary of tidal habitat quality and water quality

'Meet' or 'Fail' SAV habitat requirements, nitrogen limitation levels, or dissolved oxygen levels above 3 mg/l. Annual trends for 1999-2012 ether 'Increase' or 'Decrease' if significant at $p \leq 0.01$ or 'Maybe Increase' or 'Maybe Decrease' at $0.01 < p < 0.05$; blanks indicate no significant trend. Nitrogen trends are for total nitrogen, phosphorus trends are for total phosphorus, water clarity trends are for Secchi depth. Data is from the long-term monitoring program (2010-2012).

		Habitat Quality			Water Quality		
	Station	Algal densities	Water Clarity	Summer Bottom Dissolved Oxygen	Nitrogen	Phosphorus	Sediment
Western Branch	Upper Western Branch	MEET Maybe Dec.			FAIL Decreasing	MEET	MEET
	Mouth Western Branch	FAIL	FAIL		FAIL Decreasing	FAIL Decreasing	MEET Decreasing
Upper River	Waysons Corner	MEET	FAIL		FAIL Decreasing	FAIL Decreasing	MEET Decreasing
	Jackson Landing	FAIL	FAIL		FAIL Decreasing	MEET Decreasing	FAIL Decreasing
	Nottingham	FAIL Maybe Dec.	FAIL	MEET	FAIL Decreasing	FAIL Decreasing	FAIL Maybe Dec.
Middle River	Lower Marlboro	FAIL	FAIL	MEET Decreasing	FAIL Decreasing	FAIL Decreasing	FAIL Maybe Dec.
	Jack's Creek	MEET Increasing	FAIL	MEET	FAIL	FAIL	FAIL
	Long Pt.	FAIL	FAIL Maybe Dec.	MEET	MEET	FAIL	MEET
Lower River	Jack Bay	FAIL Increasing	FAIL Decreasing	FAIL	MEET Increasing	MEET Increasing	MEET
	Petersons Pt.	MEET Increasing	MEET	FAIL	MEET	MEET Maybe Inc.	MEET
	Pt. Patience	MEET Maybe Inc.	MEET	FAIL	MEET	MEET	MEET
	Drum Pt.	MEET Maybe Inc.	MEET Maybe Dec.	FAIL Decreasing	FAIL	MEET	MEET
	Point Lookout	MEET Maybe Increasing	MEET DECREASING	FAIL	MEET Maybe Decreasing	MEET	MEET Maybe Decreasing

Appendix with detailed results for relative status
2010-2012
annual trends
1985-2012
1985-1997
1999-2012
for 14 variables
seasonal trends
1999-2012

Shallow water quality

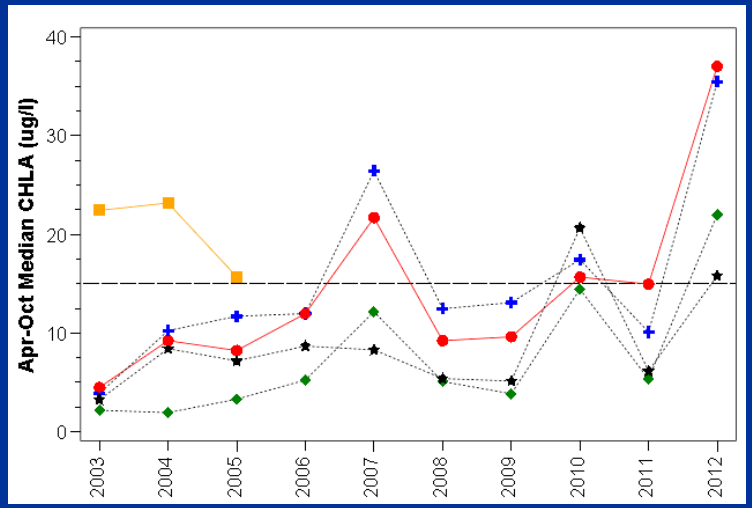
Graphs of SAV season DIN, PO_4, TSS, Chlorophyll *a*, Secchi Depth for intensive sample period

Comparison of SWM to long-term stations

Percent failure of Summer DO, Chl a and Turbidity levels

	< 10 % failure
	10 - 40 % failure
	40 - 70 % failure
	> 70 % failure

Appendix with detailed results



- Waysons Corner (LT)
- Western Branch mouth (LT)
- Jug Bay (CM)
- Jackson Landing (LT)
- PXT0435 (WQM)

Station	Location	Year	Dissolved Oxygen Threshold	Chlorophyll Threshold	Turbidity Threshold
			% < 3.2 mg/l	% > 15 ug/l	% > 7 NTU
XFB2184	Piscataway	2004	10.90	22.06	79.82
		2005	7.61	24.31	61.57
		2006	0.85	34.05	74.93
		2007	0.80	16.15	52.97
		2008	0.84	7.53	69.18
XFB0231	Fenwick	2004	0.00	3.89	60.74
		2005	0.12	0.22	43.94
		2006	0.26	0.17	29.69
		2007	0.00	1.41	26.44
		2008	0.00	0.43	35.56
XEB5404	Indian Head	2009	0.31	0.00	3.78
		2010	0.71	8.06	34.85
		2011	1.57	12.41	52.38
		2012	1.92	13.98	38.94
XEA3687	Mattawoman	2004	0.36	31.26	90.58
		2005	2.96	8.57	55.93
		2006	1.17	6.40	31.72
		2007	0.57	6.80	33.68
		2008	0.05	0.79	23.52
		2009	6.06	2.62	4.31
		2010	23.24	6.01	17.42
		2011	4.07	4.75	54.70
		2012	0.12	16.31	72.80

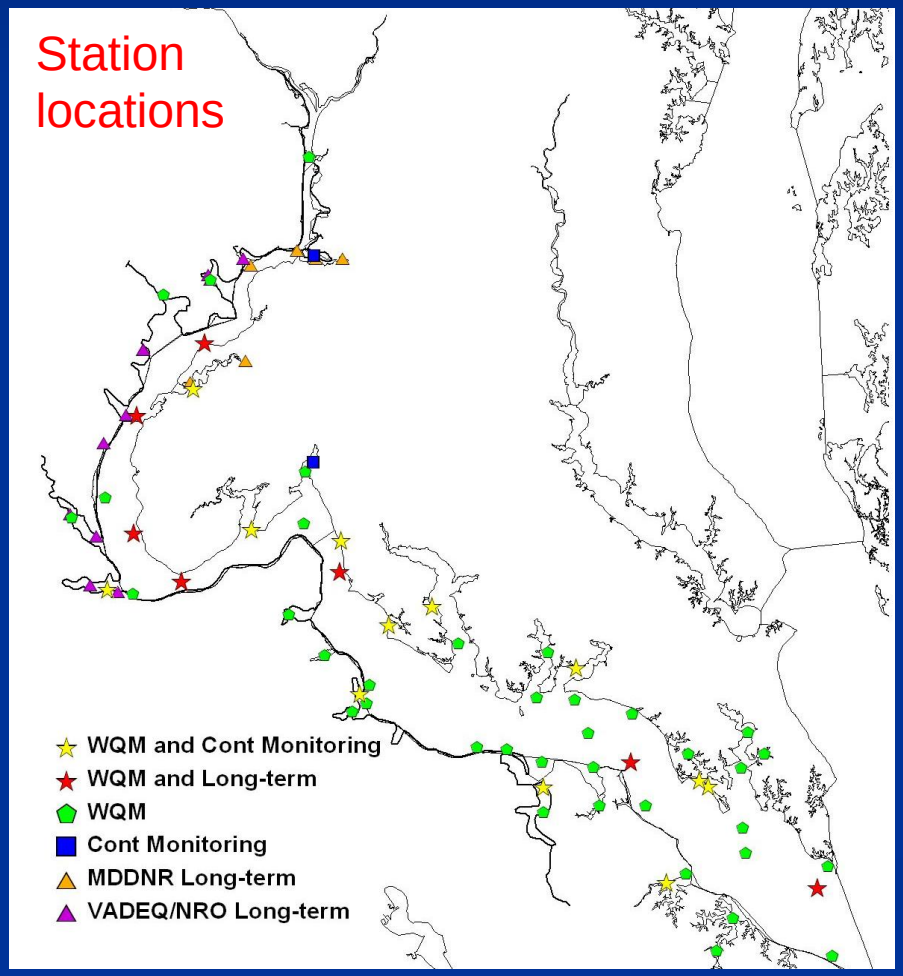
Shallow water dissolved oxygen, chlorophyll and turbidity levels
The percent of instantaneous values in each year that did not meet the thresholds: dissolved oxygen > 3.2 mg/l, chlorophyll *a* < 15 µg/l, turbidity < 7 NTU.

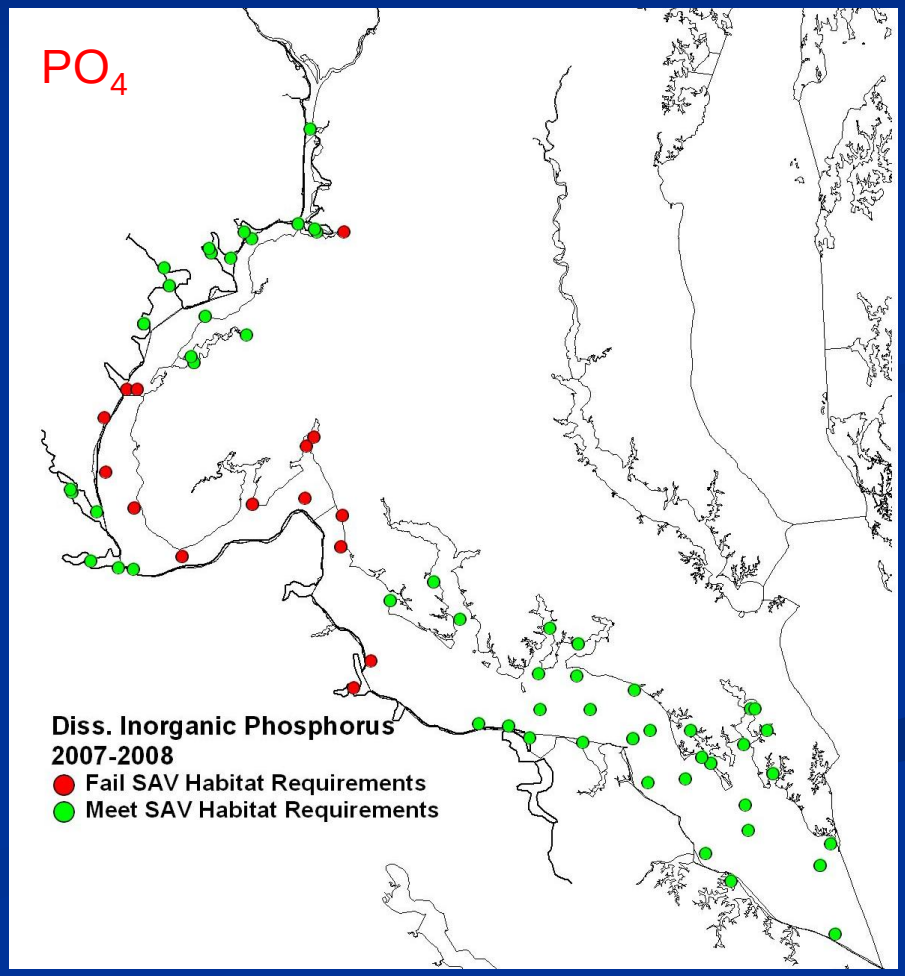
Shallow water quality- Potomac

Spatial comparison of data for overlap intensive period (2007-2008) for SAV Habitat Requirements

Intensive Period for Maryland 2006-2008; for Virginia 2007-2009

Appendix with detailed results

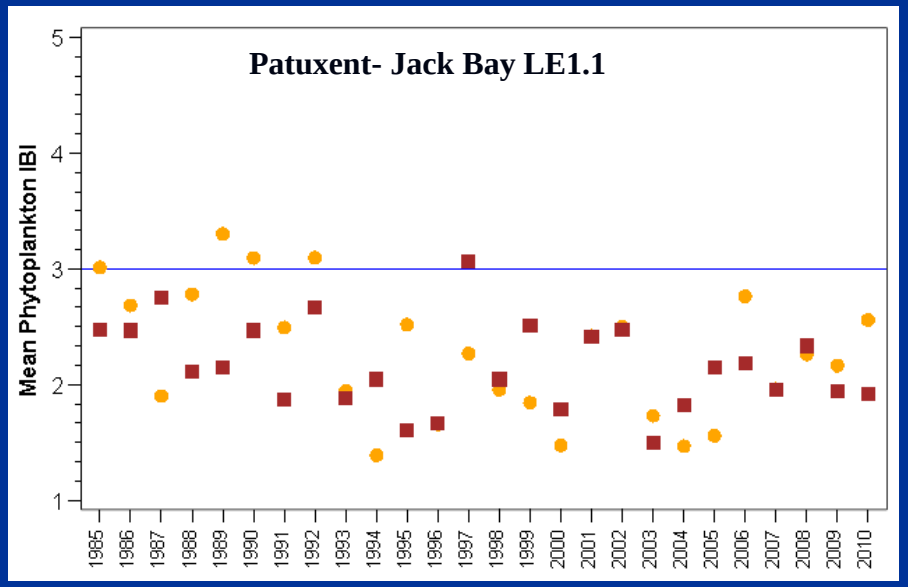


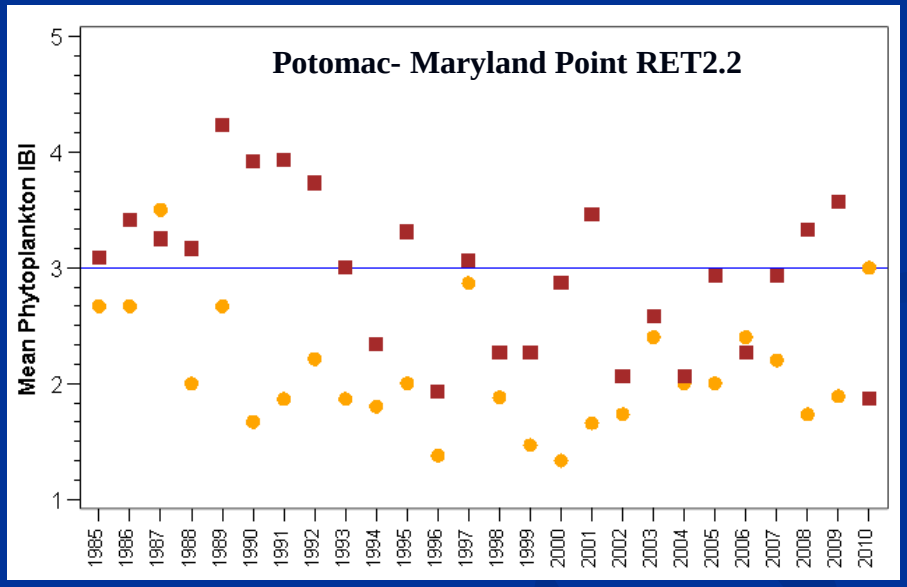


Health of Key Plants and Animals

Phytoplankton

Phytoplankton Index of Biotic Integrity, Trends 1985-2010
Harmful algal bloom information



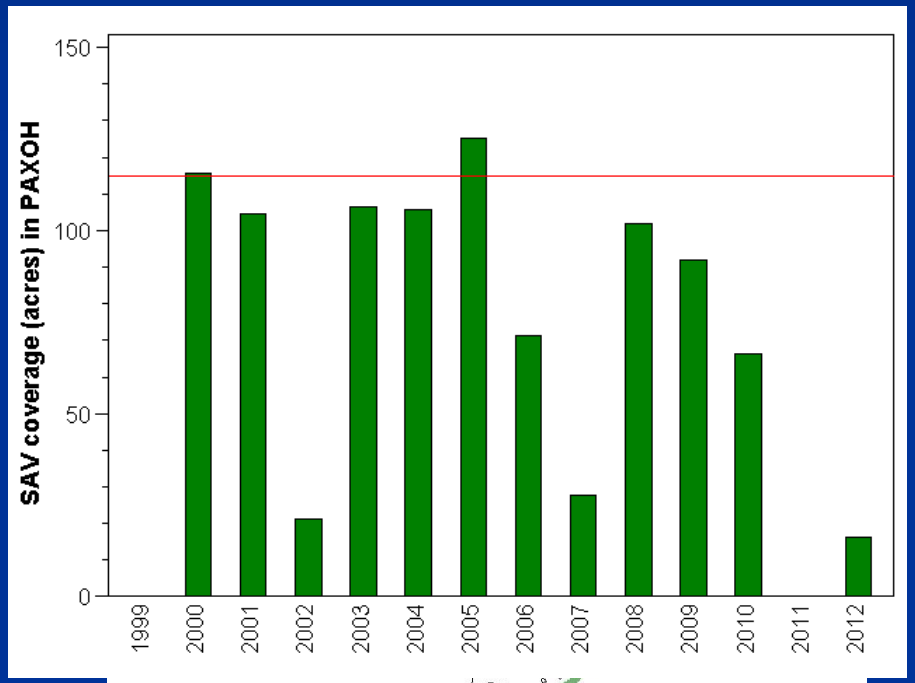


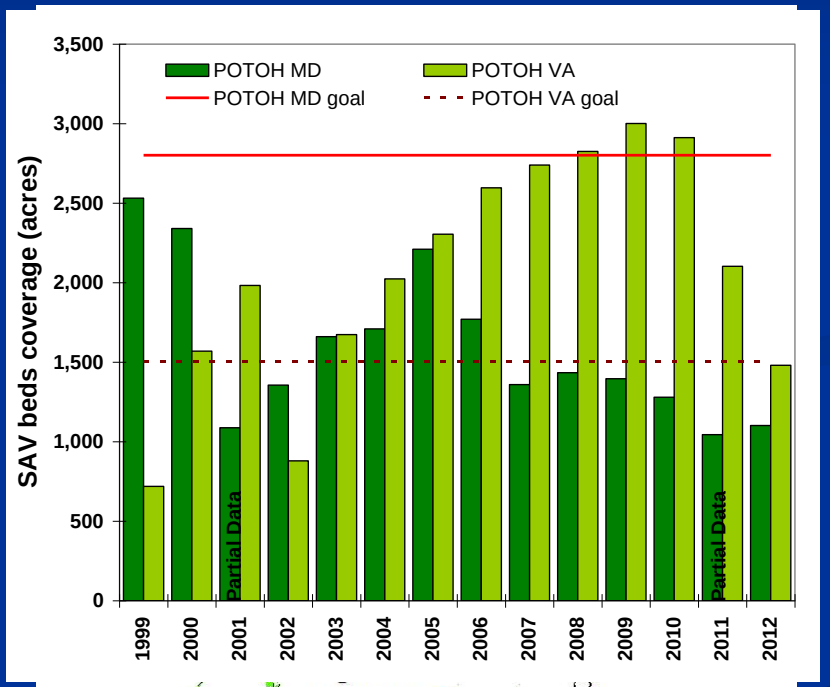
SEASON SPRING SUMMER

Health of Key Plants and Animals

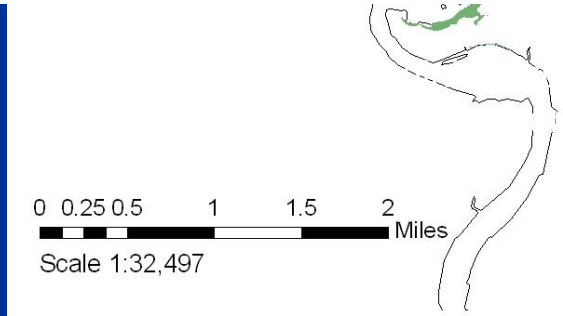
Underwater grasses

SAV acres by Bay Program segment 1999-2012
SAV coverage maps 2012* Patuxent: used 2010 because of large decrease in 2012

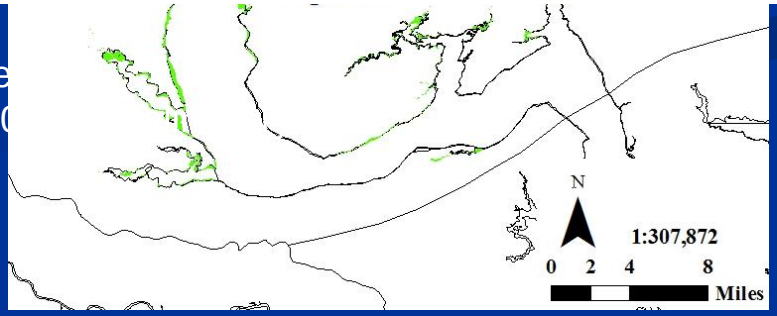




SAV
Red



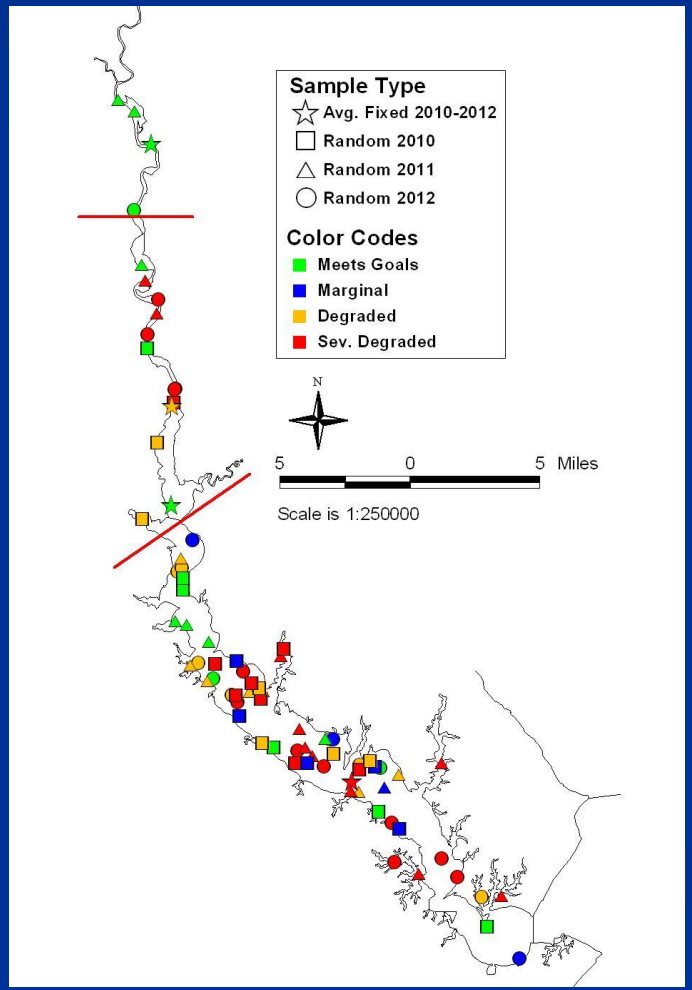
e Science
Data for 20

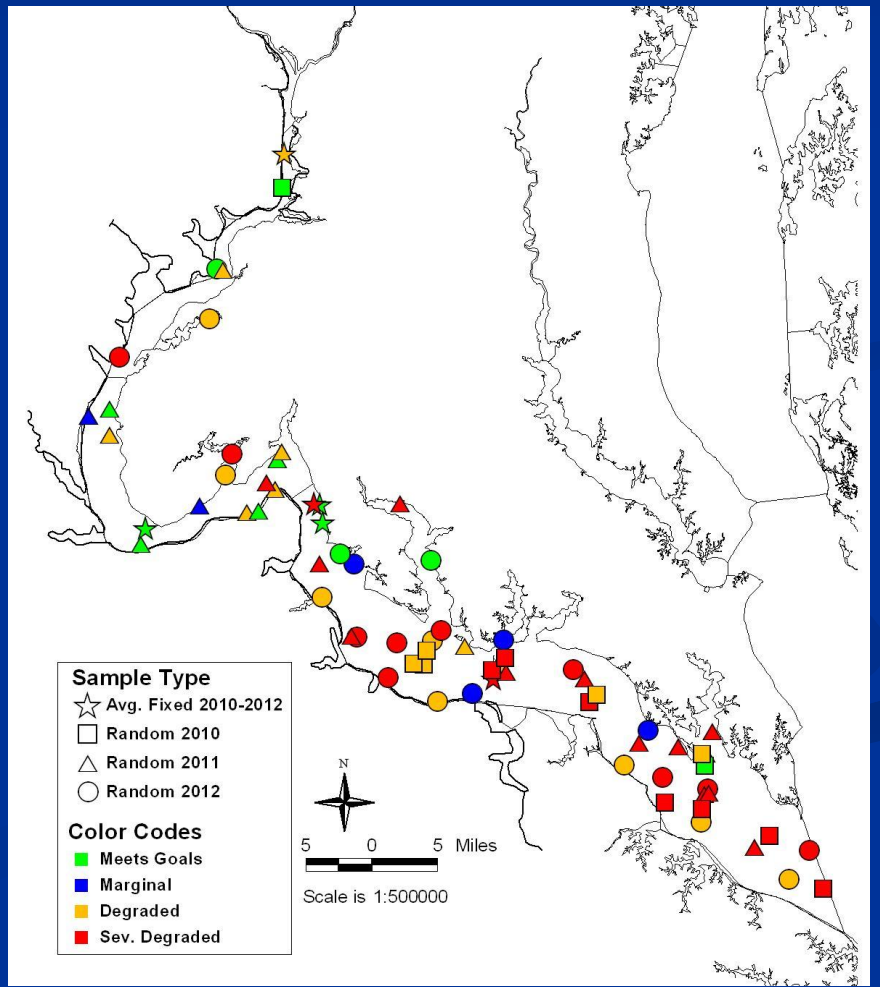


Health of Key Plants and Animals

Benthos

Benthic Index of Biotic Integrity 2010-2012, Trends 1985-2012
Severely Degraded/Degraded: % samples (2010-2012) and
% area total area 2010, 2011, 2012





Management Actions

What needs to be done to make the river healthy?

Synopsis of results from rest of report

What has already been done in to improve water and habitat quality?

BayStat information www.baystat.maryland.gov/milestone_information.html

Ag: cover crops , fencing on farmland, containment structures, stream buffers

Urban: Upgrades to major wastewater treatment plants & reductions in loadings, stormwater retrofits, septic upgrades

Land Restoration and Conservation: Program Open Space, Rural Legacy Program, Maryland Environmental Trust projects, Maryland Agricultural Land Preservation Program

http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm

Maryland.gov | Phone Directory | State Agencies | Online Services

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- How to Use This Site
- Water Quality Alerts & Social Media
- Monitoring Stories and Publications
- ***NEW*** Water Quality & Habitat Assessments
- What Does It Mean?
- Lesson Plans
- Links
- Partners
- Ask an Expert
- BayStat
- Maryland StreamHealth
- DNR Home Page

Tributary Water Quality and Habitat Assessments

Detailed reports on the health of Bay tributaries

- Upper Western Shore
  - 2010-2012 Water Quality Update
- Patapsco and Back Rivers
  - 2010-2012 Water Quality Update
- Lower Western Shore
  - 2010-2012 Water Quality Update
- Potomac River
  - 2010-2012 Water Quality Update
- Upper Eastern Shore
  - 2010-2012 Water Quality Update
- Choptank, Little Choptank and Honga Rivers
  - 2010-2012 Water Quality Update
- Lower Eastern Shore
  - 2010-2012 Water Quality Update
- Patuxent River
  - 2010-2012 Water Quality Update

ENR upgrades completion dates